

MINIATURE LIQUID-COOLED HEAT SINK WITH INTEGRAL HEATER

ABSTRACT OF THE DISCLOSURE

A temperature control device that includes a miniature liquid-cooled heat sink with integral heater and sensing elements is used as part of a system to provide a controlled temperature surface to an electronic device, such as a semiconductor device, during the testing phase. The temperature control device includes an interface surface configured to provide a thermal path from the device to a device under test. One such device has a liquid-cooled heat sink comprising a first heat transfer portion in a first plane and a second heat transfer portion in a second plane. The first and second heat transfer portions establish a three-dimensional cross-flow of coolant within the heat sink structure. An alternate embodiment includes parallel fluid conduits, each having a three-dimensional microchannel structure that directs coolant flow in three dimensions within the fluid conduits. Coolant flows in opposite directions through adjacent fluid conduits, thus resulting in a three-dimensional cross-flow within the heat sink structure.